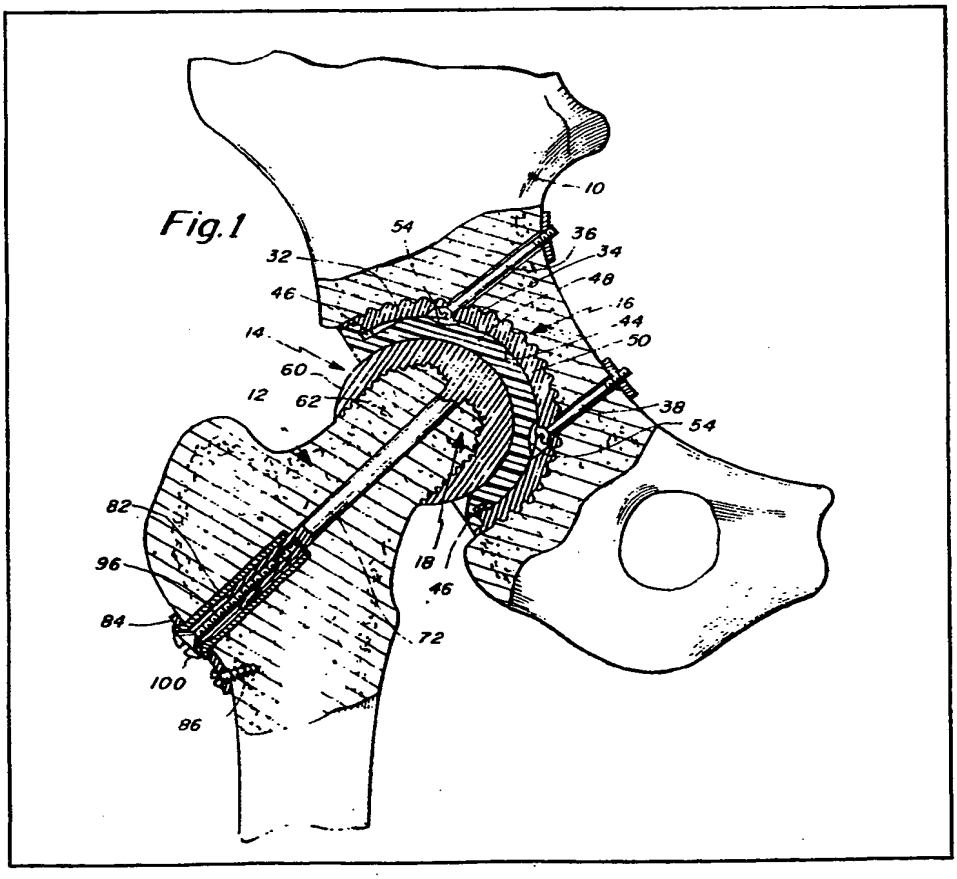
(12)UK Patent Application (19)GB (11)2 007 980 A

(21) Application No 7841468
(22) Date of filing
20 Oct 1978
(23) Claims filed
20 Oct 1978
(30) Priority data
(31) 844362
(32) 21 Oct 1977
(33) United States of America (US)
(43) Application published
31 May 1979
(51) INT CL² A61F 1/24
(52) Domestic classification
A5R AJ
(56) Documents cited
GB 1532451
GB 1511631
GB 1483938
GB 1472312
GB 1472311
GB 1340451
GB 1306027
US 3843975 A
US 3840904 A
US 3781918 A
US 3781917 A
(58) Field of search
A5R
(71) Applicants
Indong Oh
41 Country Corners Road
Wayland
Massachusetts 01778
United States of America
William Hamilton Harris
665 Concord Avenue
Belmont
Massachusetts 02178
United States of America
(72) Inventors
Indong Ho
William Hamilton Harris
(74) Agents
Venner Shipley & Co

(54) Joint replacement prostheses

(57) A prosthetic device for use in joint replacement including a socket-like component 16 having a metal shell 32 with an outer porous surface 34 for allowing bony ingrowth from the bone. A polyethylene core 48 is releasably attached to the inner surface of the shell. The replacement also includes a metal ball-like component 18 in the form of a cup having a porous inner surface which allows for bony ingrowth to permanently attach the cup in place. Fasteners 72, 36, 38 secure each of the metal components to the bone and provide immediate rigid fixation of the components at least during the initial period of bony ingrowth.



GB 2 007 980A

4 Sheets
Sheet 1
ORIGINAL

2007980

Fig.1

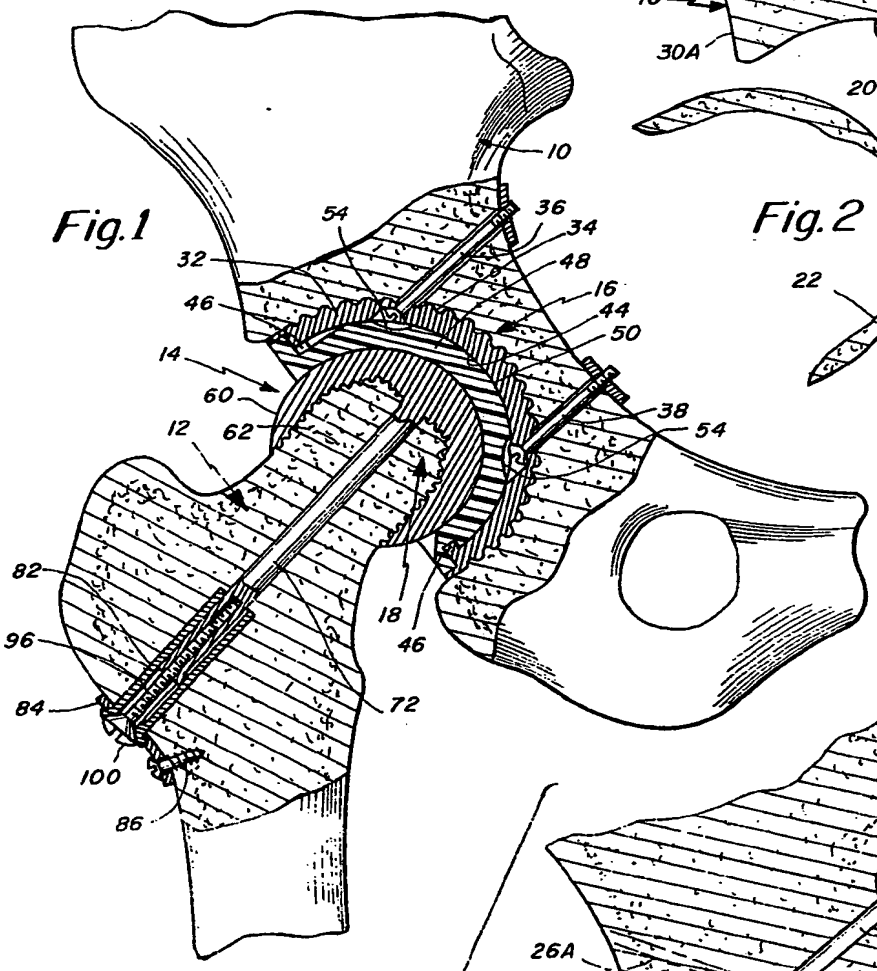


Fig.2

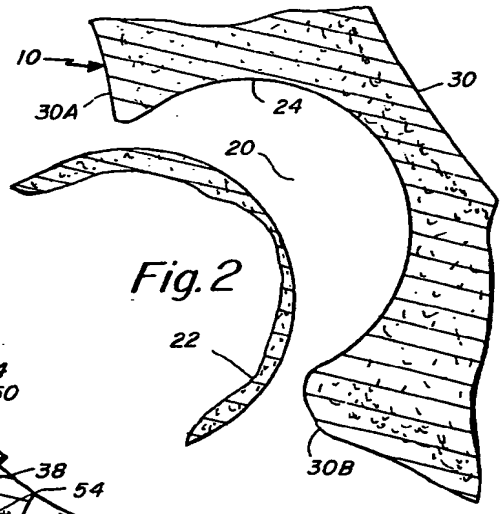
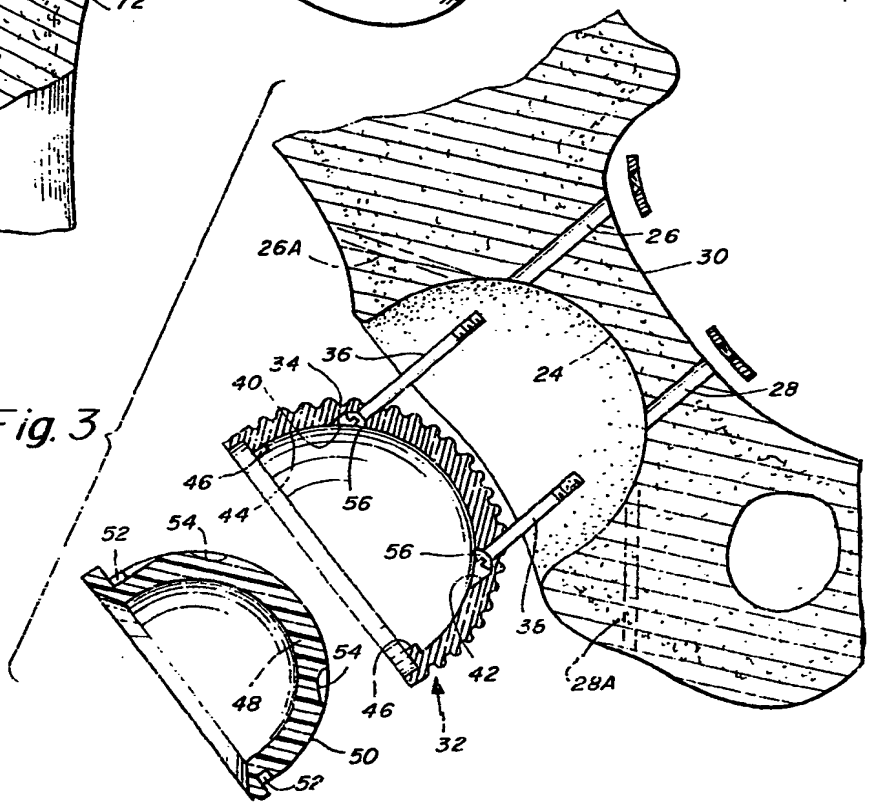


Fig.3



2007980

Fig. 4

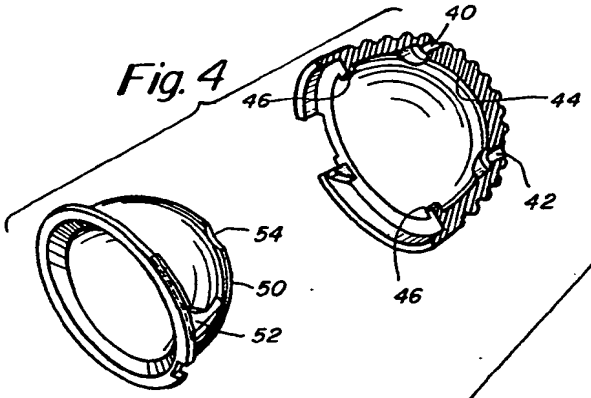


Fig. 6

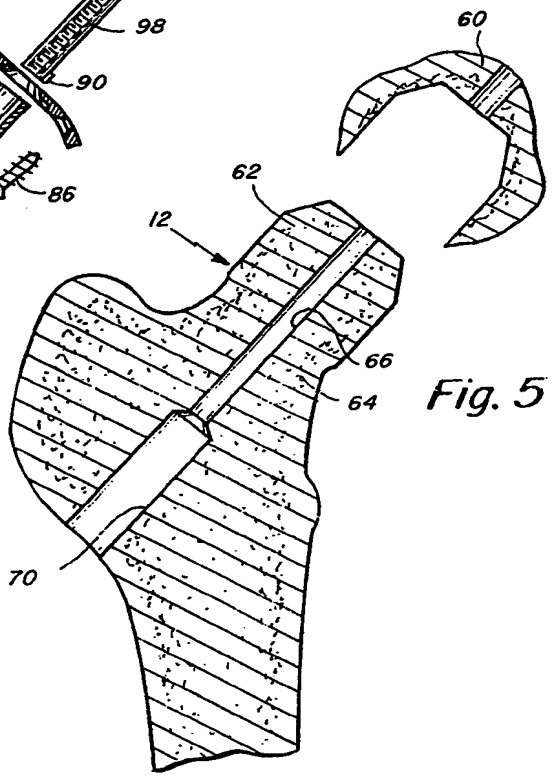


Fig. 5

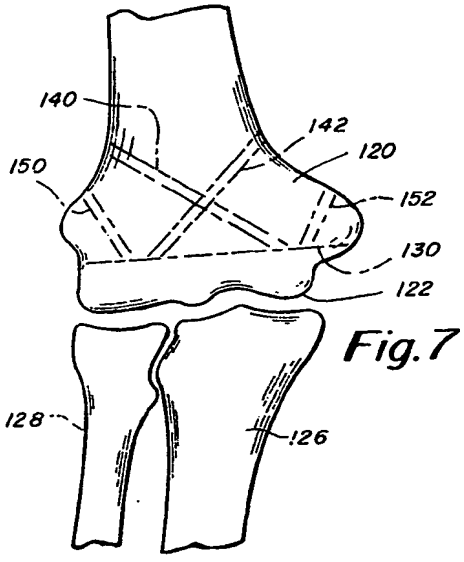


Fig. 7

2007980

Fig.8

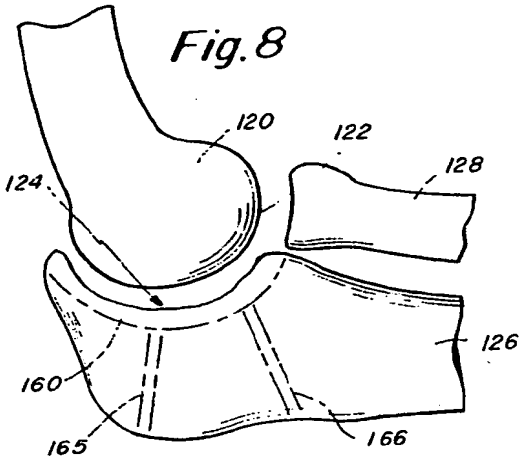


Fig.9

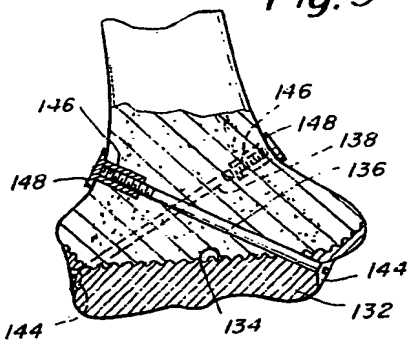


Fig.10

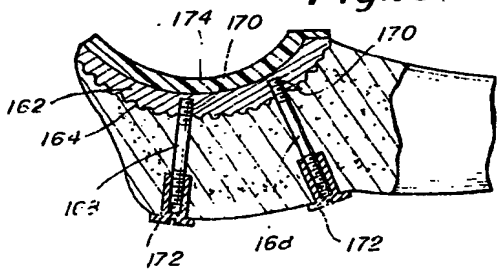


Fig.11

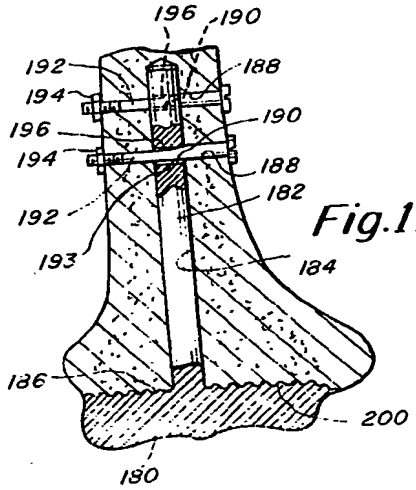


Fig.12

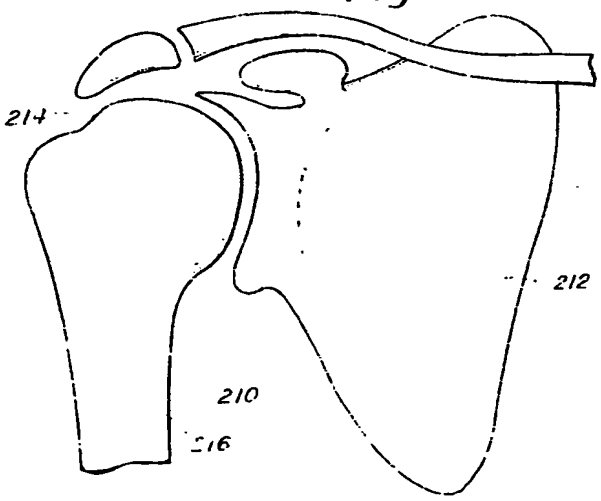
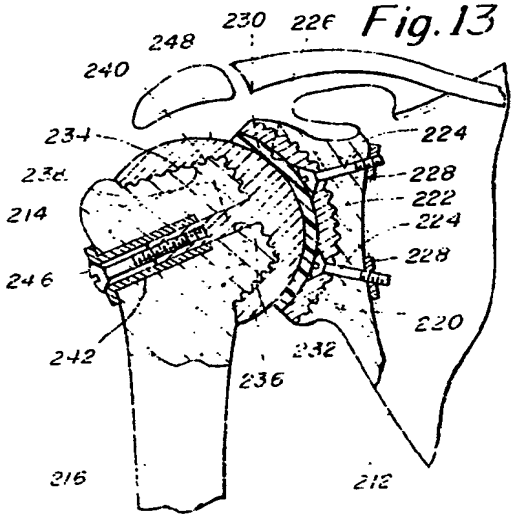


Fig.13



2007980

Fig. 14

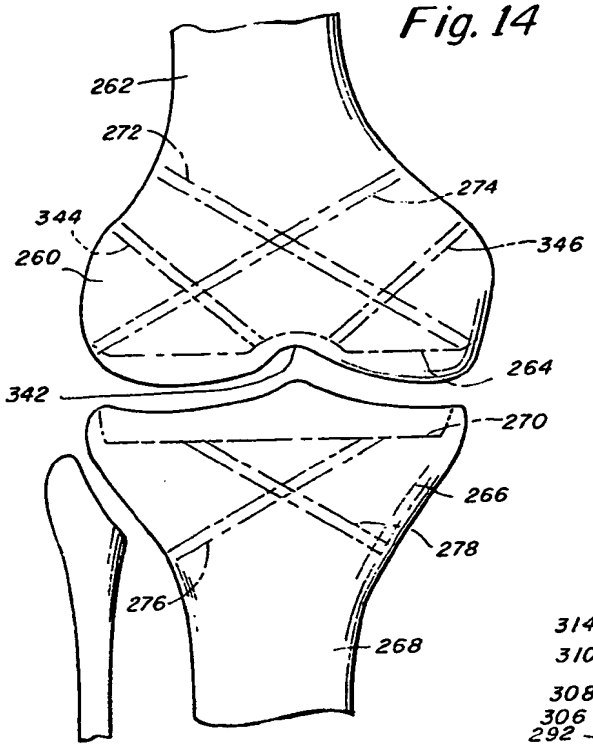


Fig. 15

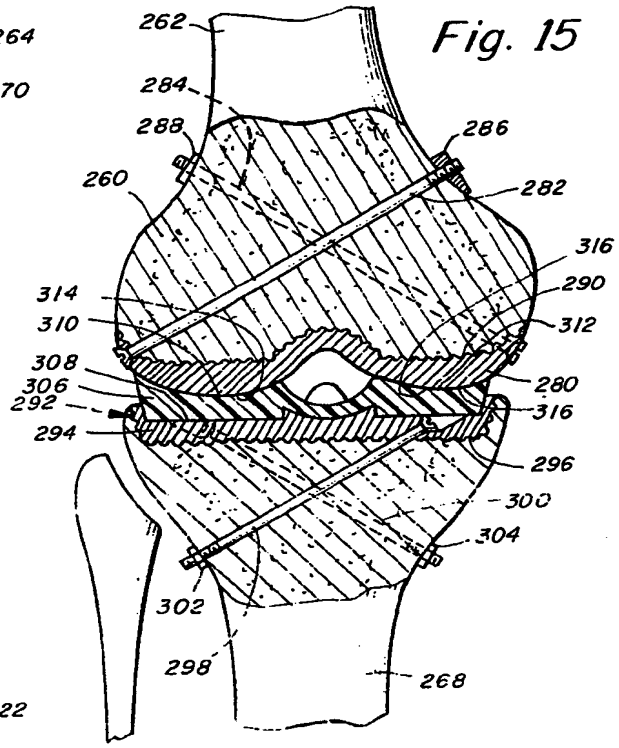
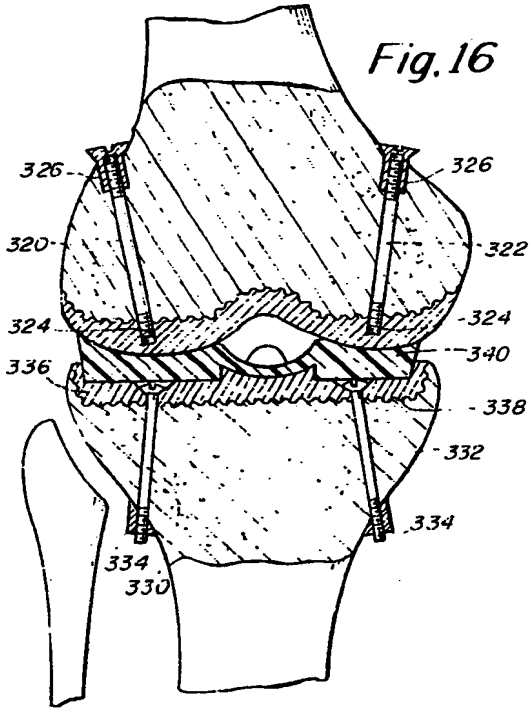


Fig. 16



SPECIFICATION

Prosthetic device for use in joint replacement

This invention relates to joint replacement with artificial components and more particularly comprises a new and improved method of and components for achieving total joint replacement of the hip, knee, elbow and shoulder which use bony ingrowth for the long-term fixation. While the invention has specific application to all of these total joint replacement procedures, in the following description emphasis is placed on its application to total hip replacement which is the most common of the several procedures.

As total hip replacement is currently practiced, the upper end of the thigh bone (femur) including the ball (femoral head) of the hip joint is replaced by a metal piece having a small sphere at one end and a stem which extends into the marrow cavity of the femur. The socket of the hip joint (acetabulum) is enlarged and replaced with a shell made of a special plastic called ultrahigh molecular weight polyethylene. Both the metal piece and the polyethylene shell are held in place by polymethyl methacrylate cement. It is used in a viscous form much like putty; the putty is forced into the bone and the components are pushed into the putty. The material then polymerizes in the body during the operation in a very short period of time and in the hardened state holds the components to the bones.

Although hundreds of thousands of people have benefited from this operation, it is now becoming apparent that the weak link in the procedure is the polymethyl methacrylate. Studies have revealed that approximately 20% of the femoral components show X-ray evidence of looseness in periods of time as short as two to four years. Other studies indicate that approximately 10% of the acetabular components become loose in a period of ten years. Thus it can be anticipated that somewhere between 20% and 30% of patients who live ten years after the total hip replacement will have mechanical failure of one kind or another.

The problems of failure of cement (polymethyl methacrylate) fixation at other joints are even more acute. For example, all of the designs of total elbow replacement used during the first half of the 1970's have failed because of looseness. The prevalence of failure to total knee replacement in many series is 20–25% after just two to four years. And the use of cement for the fixation of the shoulder components to the scapula is a vexing problem.

Considerable experimental work has been done to develop new methods of fixation of the components to eliminate the need for the polymethyl methacrylate. One of the most promising developments is the concept of bony ingrowth into porous surfaces of the prosthesis. If a surface is held rigidly against bone and contains pores of an appropriate size, generally about 100 to 500 micra in diameter, the bone itself will grow into the pores. This creates a living biologic form of fixation. One of the problems of using this technique, however, is the necessity for initial rigid stabilization of the component during the critical period while the bone is growing into the pores. This period may be anywhere from three to six weeks in duration. And if motion takes place during that period, fibrous tissues rather than bone grows into the pores and the fixation is not satisfactory.

The principle object of this invention is to improve the fixation of components in total joint replacement surgery. In accordance with this invention, the improved fixation is accomplished by incorporating into the procedure a special means for insuring immediate rigid fixation of the components together with providing a porous surface on the components so as to permit bony ingrowth.

As the invention is practiced in total hip replacement the acetabular component is in the form of a metal shell having an outer porous surface. The shell is designed to fit into the socket which has been reamed to remove the diseased bone. One or more nuts and bolts are utilized to secure the shell in rigid fixation in the socket. The bolts extend athrough holes made in the acetabulum. The shell in turn carries a plastic core or lining which may be removed and replaced if necessary because of wear or if advisable because of the availability of cores made of a more advanced material. The femoral component includes a metal cup having a porous inner surface which is designed to fit over the upper end of the reamed femur. A stem connected to the inner surface of the cup extends through a hole drilled in the femoral head and neck to the intertrochanteric area, and a screw which acts as a nut registers with a hole in the stem to apply compression through the stem to the cup when in place, to provide instant stable fixation which promotes the bony ingrowth. A sleeve is provided in the hole at the intertrochanteric area and a plate is secured to the sleeve, which bear some of the compressive load. Very similar procedures are followed when the invention is practiced in total elbow, shoulder and knee replacements.

These and other objects and features of this invention will be better understood and appreciated from the following detailed description of several embodiments thereof, selected for purposes of illustration and shown in the accompanying drawings.

Figure 1 is a cross sectional view of the human hip showing a total hip joint replace-

ment in accordance with this invention.

Figure 2 is a cross sectional view showing the first step in preparing the acetabulum for the implant of the artificial socket in accordance with this invention.

Figure 3 is an exploded view of the acetabulum and implant components and suggesting the other steps in the procedure of attaching the acetabular component in accordance with the invention.

Figure 4 is a detail view showing the manner in which the core is releasably mounted in the shell of acetabular component.

Figure 5 is a cross sectional view showing the manner in which the femur is prepared for the implant in accordance with this invention.

Figure 6 is an exploded view of the upper end of the femur and the several parts of the femoral component and suggesting the steps in the implant procedure in accordance with this invention.

Figures 7 and 8 are front and side views respectively of an elbow joint prior to total elbow replacement surgery.

Figure 9 is a front view partially in cross section of the condyle end of the humerus after implant of the prosthesis.

Figure 10 is a side view partially in cross section of the socket end of the ulna after implanting the prosthesis.

Figure 11 is a view of the humerus similar to Fig. 9 and showing an alternative technique for immediate fixation of the prosthesis.

Figure 12 is a front view of a shoulder joint prior to total shoulder replacement surgery.

Figure 13 is a front view, partially in cross section after implant of the glenoid and humerus components in accordance with this invention.

Figure 14 is a front view of a knee joint prior to total knee replacement surgery.

Figure 15 is a front view, partially in cross section of the knee joint of Fig. 14 after total knee replacement in accordance with this invention.

Figure 16 is a view similar to Fig. 15 showing an alternative technique for immediate fixation of the prosthesis.

The invention is first described as it is practiced in total hip replacement surgery. Thereafter it will be described in connection with total joint replacement surgery of the elbow, shoulder and knee.

In Fig. 1 a human hip is shown, which has had a total hip replacement in accordance with the present invention. The acetabulum 10 forming part of the pelvis is connected to the upper end of the femur 12, commonly called the thigh bone, by means of implanted components collectively identified at 14. Separate acetabular and femoral components 16 and 18 respectively comprise the artificial joint. The components 16 and 18 are separately connected by essentially independent procedures to the acetabulum and femur.

In accordance with this invention, the acetabulum 10 is prepared by reaming the socket 20 so as to remove the diseased portion 22 of the bone as suggested in Fig. 2. With the reaming, an accurately machined hemispherical recess 24 remains, into which the acetabular components are mounted. After reaming, one or more holes (holes 26 and 28, in Fig. 3) is drilled through the acetabulum from the base of the socket 24 to the interior 30 or exterior 30A and/or 30B of the pelvis. In Figs. 1–3 the holes 26 and 28 are shown drilled to the interior of the pelvis, but depending upon the condition and shape of the acetabulum, it may be more suitable to orient the holes so that they extend from the socket 24 to the pelvis exterior 30A and 30B as suggested by the broken lines at 26A and 28A in Fig. 3.

A metal acetabular shell 32 typically made of a cobalt chromium alloy (Vitallium) or stainless steel or some other suitable material compatible with the body and having an outer porous surface 34 fits within recess 24. The recess is accurately machined so that it receives the shell as a press fit. The porous surface 34 of shell 32 may be established in several ways. For example, the exterior surface of the shell may be roughened to create pores of an appropriate size, generally above 100 micra in diameter. Or the surface may be sintered to create the porous structure. Alternatively, a fine mesh screen may be secured to the surface to define the pores. The critical feature is that the surface be irregular so that bony ingrowth may mechanically lock the shell in place.

After the shell 32 is pressed into the socket 24, the bolts 36 and 38 are inserted through the holes 40 and 42 provided in the shell and through the drilled holes 26 and 28 in the acetabulum. It is contemplated that the shell may be provided with a number of holes and/or the holes in the shell may be elongated to allow the surgeon to drill the holes in the acetabulum in any orientation dictated by the condition and shape of the bone. It is to be understood that while two bolts are shown, a different number may be used at the discretion of the surgeon. It is also contemplated that at least one bolt will pass through the metal shell into the pelvis. The nut on that bolt may be placed on the bolt from inside the pelvis. This may be done through a short incision which passes medially to the sartorius muscle under the iliopsoas muscle. Another bolt may pass in a superior and lateral direction through the metal shell and bone. The nut on that bolt may be placed on the bolt against the lateral surface of the ilium underneath the origin of the gluteus medius and gluteus minimus muscles. These bolts and nuts will provide immediate rigid fixation at the time of insertion of the shell and while new bone grows into the pores of the surface

34.

The inner surface 44 of shell 32 carries several locking lugs 46. The lugs 46 are provided to removably support the replaceable polyethylene core 48 which is essential for articulation with the metal femoral component described in detail below. As shown in Fig. 1, the inner surface of the core is smooth and receives the ball of the femoral component. The core 48 on its outer surface 50 is provided with a number of slots 52 that correspond in number to the lugs 46, and the two provide a bayonet-type lock to maintain the core 48 in position in shell 32. This arrangement is shown in Fig. 4. The outer surface 50 is also provided with recesses 54 to accommodate the heads 56 of bolts 36 and 38.

The core 48 typically may be made of an ultrahigh molecular weight polyethylene identified such as that sold by Rhure Chemie under the mark RCH1000. This material is well recognized in the medical field today. The core 48 by virtue of its releasable lock mounting on the shell can be replaced without having to remove the metal shell. Thus, if the core required replacement because of wear, this may be done without facing the difficult task of removing the shell after bone has grown into the porous surface 34. It is also contemplated that at some time a superior material may be developed which would function better than the ultrahigh molecular weight polyethylene. A core made of the new material may be used either during the initial insertion of the acetabular component or at any time replacement of the core becomes necessary.

Fig. 5 suggests the manner in which the upper end of the femur is prepared for the implant. A hole 66 is drilled through the head 62, femoral neck 64 and through the lateral cortex of the femur in the intertrochanteric area. The hole 66 may be enlarged at the intertrochanteric area as suggested at 70. The drilled hole 66 accommodates a stem 72 that anchors the cup or hemispherical portion 74 of the femoral component in place. After the hole is drilled the diseased femoral head 60 is reamed off so as to leave the head 2 of reduced size composed of healthy bone. The reduced size of the femur is dictated in part by the size of the femoral neck 64. The reaming is necessary in order to reduce the volume of the head so as to accommodate the implant components themselves. In Fig. 5 the reaming of the head is suggested by the removed bone 60.

The cup 74 should be made of the same material as the shell 32 and is provided with a recess 76 which corresponds in shape to the reduced head 62 of the femur. The inner surface of the recess 76 including the bottom 80 and the cylindrically shaped side 81 in the same fashion as surface 34 of shell 32 in the acetabular component so as to permit bony ingrowth from head 62 to achieve biologic fixation of cup 74.

A sleeve 82 extends through a hole in plate 84 and is mounted in the enlarged portion 70 of hole 66. When the sleeve 82 is in the bone, the plate 84 lies against the outer cortical surface of the intertrochanteric area, and the plate may be anchored aginst rotation by means of a screw 86 which extends through plate 84 into the femur as suggested in Fig. 1. Sleeve 83 as shown has a keyway 88 extending axially along its inner surface, and the keyway receives a radial pin 90 formed on the outer surface of stem 72 to prevent the stem from rotating. Stem 72 as shown is fixed to the bottom 80 of cup recess 76 so that the two function as a unitary structure. The two may, however, be made as separate elements and interlock by any convenient means. The stem is anchored in place by a compression screw 96 that acts as a nut in cooperation with plate 84 and sleeve 82. When the screw 96 is tightened, its head 100 bears against the outer end 102 of sleeve 82, and as the screw continues to turn, the stem 72 is drawn downwardly so as to draw the hemispherical cup 74 rigidly against the bone to hold it firmly in place. As a result, the bony ingrowth is promoted without the growth of fibrous tissue.

The stem 72 not only provides fixation for the cup 74 during the period of bony ingrowth, but it also reinforces the femoral neck so as to resist fracture or failure, which is one of the serious complications that can occur following replacement of the surface of the femoral head in this type of total hip reconstruction.

From the foregoing description those skilled in the art will appreciate that unique acetabular and femoral components are provided which have many advantages. The unique acetabular component includes a combination of the metal shell with a porous surface on the outside, which is press fitted into the accurately machined hemispherical recess in the hip socket. One or more bolts is used to achieve immediate fixation of the shell prior to the insertion of the polyethylene core. And the polyehtylene core may be replaced if worn or if better materials become available. The unique femoral component includes a cup having a porous surface comparable to that of the shell of the acetabular component to promote bony ingrowth. The stem which provides immediate fixation for the cup reinforces the femoral neck, and the compression provides the best form of rigid stabilization to promote bony ingrowth. The stem itself may have a porous surface so as to provide an additional area of bony ingrowth to stabilize the entire system. And in accordance with the unique method of this invention, immediate fixation is achieved of the components by mechanical means such as bolts and nuts and stems with

compression screws to promote the bony ingrowth which provides a biologic form of fixation.

This invention as practiced in total elbow replacement is illustrated in Figs. 7–11. In Figs. 7 and 8 the elbow joint before the attachment of the prosthesis is shown in front and side views respectively. The humerus 120 has a lower end 122 known as a condyle that fits within a socket 124 at the upper ends of the ulna 126 and radius 128. In Fig. 7 the lower surface of the condyle 122 is traversed by a broken line 130 which suggests the level to which the humerus may be reamed in preparation to accept the metal cup 132. The metal cup 132 is provided with an irregular inner surface 134 like the corresponding surfaces in the components used in the hip replacement, and immediate and secure fixation of the cup is achieved by means of the nuts and bolts 136 and 138 which extend through holes 140 and 142 respectively that are drilled in the condyle of the humerus after the lower end has been reamed to the plane of line 13. The bolts 136 and 138 are each provided with heads 144 that lie within the surface of the cup 132 in suitable recesses provided for that purpose. The bolts extend through the holes 140 and 142 and are attached at the other end by means of nuts 146, each of which carries a head 148 that lies against the outer surface of the humerus at the regions of the lateral and medial condyles. Thus just as in the acetabular component in the total hip replacement shown in Figs. 1 to 6, in this embodiment of the invention the cup is held in place by a pair of bolts and cooperating nuts that provide immediate fixation which is very secure and which is capable of drawing the cup firmly against the bone to apply appreciable compressive forces at the interface of the prosthesis and bone.

While in Fig. 9 two bolts are shown to traverse the end of the humerus and essentially cross one another, it will be understood that the bolts may pass in other directions as dictated by the size and condition of the humerus. For example, the holes for the bolts could be drilled as suggested at 150 and 152, and the bolts in that case would extend outwardly from the cup and be secured in place by appropriate nuts resting on the upper surfaces of the condyles.

In Fig. 10, the component used in socket 124 is shown. The socket is prepared in the ulna as suggested by the broken line 160 in Fig. 8, and thereafter the shell 162 having an irregular or porous surface 164 is firmly seated in the socket in the same fashion as the acetabular shell in the hip replacement. Holes 165 and 166 may be drilled in the ulna from the socket 124 to accommodate the bolts 168 which screw into internally threaded sockets 170 provided in the convex surface of shell 162. The outer end of bolts 168 are drawn downwardly by means of the nuts 172. Thus, as the nuts 172 are tightened, the bolts 168 are drawn downwardly so as to seat the shell 162 very firmly in place. Thus bony ingrowth is promoted. An ultrahigh density polyethylene core 174 is removably secured to the concave surface of the shell 162 by the same techniques shown in Fig. 4 in connection with the acetabular component. The smooth inner surface of the polyethylene core receives the ball formed as an integral part of the metal cup 132 so as to permit the articulation of the joint.

In Fig. 11 yet another means of attaching the component to the humerus is shown. In this form, the metal cup 180 carries a stem 182 which is disposed in a hole 184 drilled in the humerus. The inner surface 186 of the cup is provided with an irregular or porous surface just as the other components of this invention, and the stem 184 may also have an irregular or porous surface to accept bony ingrowth. A pair of transverse holes 188 are drilled through the humerus and which intersect the hole 184. Holes 190 in the stem 182 also accommodate bolts 192 that extend through the holes 188, and the bolts are fixed in place by the nuts 194. The bolts 192 may each be provided with a flat surface along the lower edge 193 and a wedged shaped surface along the top edge as suggested at 196 to exert a pulling action upon the stem 182 when they pass through the holes 190 in the stem so as to draw the stem upwardly and cause appreciable compression to exist at the interface of the irregular surface 186 of the cup and the mating surface 200 of the humerus bone.

In Figs. 12 and 13 the application of this invention in total shoulder replacement is illustrated. In Fig. 12 the glenoid 210 which is the articulating surface of the scapula 212 is shown adjacent the head 214 of humerus 216. In Fig. 13 the glenoid and humerus head are shown after the total joint replacement has been performed. As in the other embodiments, the socket formed in the glenoid is reamed to accommodate the shell 220 made of metal and having an irregular or porous surface 222 which engages the scapula bone. One or more holes is drilled through the glenoid to receive bolts 224 having heads which lie in the concave surface 226 of shell 220. The bolts 224 are held in place by nuts 228, and the bolt and nut fasteners apply substantial compression at the interface of the irregular surface 222 of the shell and the bone. In this fashion immediate fixation is achieved. The shell is lined with an ultrahigh density polyethylene core 230 which may be fixed on the cup in the same fashion as the core and shell of the acetabular component shown in Fig. 4.

A hole 232 is drilled in the humerus head

214, and the head is reamed as suggested at 234 in the same fashion as the femoral head as shown in Fig. 5. Metal cup 236 having an irregular or porous concave surface 238 is held firmly on the head 214 by means of a stemp 240 carried by the cup, a sleeve 242 positioned in the counterbored portion of the hole 232, and a screw 246, in the same fashion as is the cup in the femoral component. The smooth outer surface 248 of the cup articulates in the smooth concave surface of the core 230. And bony ingrowth is promoted at both the humerus head and the glenoid because of the immediate rigid fixation of the components by means of the bolt-type fasteners.

In Figs. 14 to 16 the application of this invention in total knee replacement is illustrated. In Fig. 15 the lower or condyle end 260 of the femur 262 is traversed by a broken line 264 which suggests how the condyle should be reamed in preparation for the implant. Similarly, the upper end 266 of the tibia 268 should be prepared for the implant. In addition, holes 272 and 274 are drilled in the femur 262 and holes 276 and 278 are drilled in the upper end of the tibia to receive the fastening bolts. In Fig. 15 the metal cup 280 is shown secured in place by bolts 282 and 284 and their corresponding nuts 286 and 288 respectively, and cup 280 has an irregular or porous inner surface 290 which is held in compression against the bone of the condyle 260 to permit bony ingrowth to biologically fix the cup in place. Once again, the bolts and nuts apply compression at the interface of the cup and bone and establish immediate rigid fixation.

The tibia component 292 includes a shell or base 294 made of metal and having an irregular surface 296 which bears against the reamed surface of the tibia in the same fashion as described in connection with the other embodiments of this invention. A pair of bolts 298 and 300 extend through the holes 276 and 278 drilled in the head of the tibia, and compression is applied at the interface of the component 294 and the bone by tightening the nuts 302 and 304. An ultrahigh density polyethylene core 306 is secured to the upper surface 308 of component 294 and it may be held in place in the same fashion as the metal shell and plastic core are held together in Fig. 4. The two concave surfaces 310 and 312 in the core provide a mating surface with the ball portions 314 and 316 respectively of the cup component 280.

In Fig. 16 another means of fixing the metal cup and shell to the femur and tibia is suggested, which corresponds to the alternative technique suggested in the total elbow replacement of Fig. 10. The fastening bolts 320 and 322 extend to the face of the lateral and medial condyles and do not cross one another as in Fig. 15. The bolts screw into sockets 324 provided in the irregular generally concave surface of the shell, and nuts 326 provide the compression for immediate firm fixation of the cup. In a similar fashion, bolts 330 and 332 with their respective nuts 334 apply compression to retain the femur component 336 with its irregular surface 338 in place. And the component carries a core 340 that may be removable in the same fashion as the cores in the other embodiments. As yet another alternative, the holes for the bolts could extend from the intercondylar notch 342 as suggested at 344 and 346 of Fig. 14.

In all of the embodiments of this invention, immediate rigid fixation is achieved from the components so that bony ingrowth may occur at the joint so as ultimately to achieve the biologic form of fixation which is so desirable. And the immediate fixation is achieved without subjecting the bone to tension forces that are created by the use of screws and some other types of fasteners that thread directly into the bone. The cooperation of the bolts and their anchoring means subjects the bone only to compression. It will also be appreciated that in accordance with one aspect of this invention the wearing surface of the joint defined by the plastic component may be replaced without disturbing the bony ingrowth that provides superior anchorage for the metal components.

Because modifications may be made of this invention without departing from its spirit, it is not intended that the breadth of this invention be limited to the specific embodiments illustrated and described. Rather, it is intended that the scope of this invention be determined by the appended claims and their equivalents.

CLAIMS

1. A prosthetic device for use in joint replacement, comprising a metal member adapted to be secured to a bone, a porous or irregular surface on said member on the side which, in use, will contact the bone for fixation of said member to the bone by bony ingrowth, and fastening means engaging the member and the bone to apply compression to the bone for fixing the member to the bone at least during a period of initial bony ingrowth into said surface.

2. A prosthetic joint replacement, comprising a first metal member adapted to be secured to a bone, a porous or irregular surface on said first member on the side which, in use, will contact the bone for fixation of said member to the bone by bony ingrowth, first fastening means engaging the member and the bone to apply compression to the bone for fixing said first member to the bone at least during a period of initial bony ingrowth into said surface, a core or lining of plastics material secured to the side of said first member opposite to that having the porous or irregular

surface for receiving a second metal member adapted to be secured to the other bone of the joint, a porous or irregular surface on said second member on the side which, in use, will contact said other bond for fixation of said second member to said other bone by bony ingrowth, second fastening means engaging the second member and the other bone to apply compression to the other bone for fixing the second member to the other bone at least during a period of initial bony ingrowth, and a smooth surface on said second member for engagement in said core or lining.

3. A prosthetic device as claimed in claim 1 or 2, wherein the or each porous or irregular surface comprises a roughened surface, or a sintered surface, or a fine mesh screen secured to the surface.

4. A prosthetic device as claimed in claim 3, wherein the pores in said surface are at least 100 micra in diameter.

5. A prosthetic device as claimed in any of the preceding claims, wherein the fastening means comprise at least one nut and bolt.

6. A prosthetic device as claimed in claim 5, wherein at least one hole is drilled in said metal member to receive the bolt.

7. A prosthetic device as claimed in claim 6, wherein said at least one hole is laterally elongated.

8. A prosthetic device as claimed in claim 1 or in any of claims 3 to 7, wherein a core or lining of plastics material is secured to the side of said metal member opposite to that having the porous or irregular surface.

9. A prosthetic device as claimed in claim 2 or 8, wherein said core or lining is detachably secured to the metal member to permit replacement of said core or lining.

10. A prosthetic device as claimed in claim 2, 8 or 9, wherein the core or lining is made of ultrahigh molecular weight polyethylene.

11. A prosthetic device as claimed in claim 2 or any of claims 3 to 10 appendant thereto, wherein said first member is shaped to be secured to the glenoid and said second member is shaped to be secured to the head of the humerus.

12. A prosthetic device as claimed in claim 2 or any of claims 3 to 10 appendant thereto, wherein said first member is shaped to be secured to the upper end of the tibia and the second member is shaped to be secured to the condyle end of the femur.

13. A prosthetic device as claimed in claim 1 or any of claims 3 to 10, wherein the metal member is shaped to be secured to the glenoid of the shoulder joint.

14. A prosthetic device as claimed in claim 1 or any of claims 3 to 10, wherein the metal member is shaped to be secured to the tibia of the knee joint.

15. A prosthetic device as claimed in claim 1 or any of claims 3 to 10, wherein the metal member is shaped to be secured to the ulna of the elbow joint.

16. A prosthetic device as claimed in claim 2 or any of claims 3 to 10 appendant thereto, wherein the first member is shaped to be secured to the ulna of the elbow joint and the second member is shaped to be secured to the condyle end of the humerus of the elbow.

17. A prosthetic device as claimed in claim 2 or any of claims 3 to 10 appendant thereto, wherein the first member is shaped to be secured to the tibia of the knee joint and the second member is shaped to be secured to the condyle end of the femur.

18. A prosthetic device for use in hip replacement, comprising a metal acetabular shell adapted to be seated in a recess in the hip socket, a porous or irregular surface on the outside of the shell for the fixation of the shell in the socket by bony ingrowth into said surface, bolt means adpated to engage the shell for fixing the shell to the pelvis particularly during the period of initial bony ingrowth into the porous surface, a core secured to the shell, a metal femoral head adapted to fit within the core and having a cavity for receiving the upper end of the femur, a porous or irregular surface lining the cavity for the fixation of the head by bony ingrowth into the surface, and means including a stem secured to the head within the cavity and adapted to extend through a hole in the femur for attaching the head in place on the upper end of the femur.

19. An acetabular prosthetic device for use in total hip replacement surgery, comprising a acetabular shell of metal adapted to be seated in a recess in the hip socket, an irregular surface on the outside of the shell for the fixation of the shell in the recess by bony ingrowth into the said surface, and bolt means adapted to engage the shell and apply compression to the pelvis for fixing the shell to the pelvis particularly during the period of initial bony ingrowth into the surface.

20. An acetabular prosthetic device as claimed in claim 19, further characterized by a core attached to the shell and defining a socket-like recess adapted to receive the ball-type component of the hip joint.

21. An acetabular prosthetic device as claimed in claim 20, wherein said core is detachably secured in said recess.

22. An acetabular prosthetic device as claimed in claim 19, wherein said bolt means have an irregular surface for bonding to bony ingrowth.

23. An acetabular prosthetic device as claimed in claim 19 or 22, wherein a hole is provided in the shell through which the end of the bolt means extends, and the end of the bolt means extend through the shell lying beneath the core.

24. An acetabular prosthetic device as

claimed in claim 20 or 21, wherein said core is made of a plastics material.

25. A femoral prosthetic device for use in hip replacement surgery comprising a generally hemispherically shaped metal femoral head cup having a cavity extending inwardly from the side thereof, opposite the hemispherical surface, said cavity being adapted to receive the upper end of the femur, an irregular or porous surface lining the cavity for the fixation of the cup by bony ingrowth into the surface, and means including a stem secured to the cup within the cavity and adapted to extend through a hole in the femur head and neck for attaching the cup in place on the upper end of the femur.

26. A femoral prosthetic device as claimed in claim 25, wherein said means further include a sleeve surrounding the stem at its end remote from the cup, and a compression screw extending into the sleeve from its end remote from the cup and screwed into the stem for drawing the cup tightly against the upper end of the femur.

27. A femoral prosthetic device as claimed in claim 26, wherein a plate is secured to the end of the sleeve remote from the cup and is adapted to be attached to the intertrochanteric area of the femur.

28. A prosthetic device for use in joint replacement substantially as hereindescribed with reference to and as shown in any of the accompanying drawings.

Printed for Her Majesty's Stationery Office
by Burgess & Son (Abingdon) Ltd.—1979.
Published at The Patent Office, 25 Southampton Buildings,
London, WC2A 1AY, from which copies may be obtained.